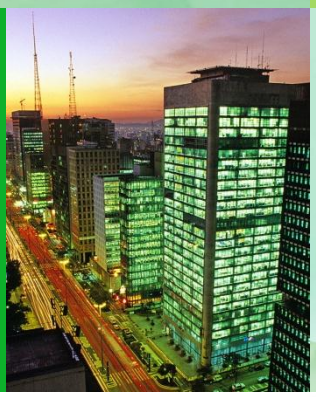
An open forum for collaboration, the SGIP establishes stakeholder requirements, sets priorities, and coordinates development of the standards for Smart Grid interoperability and cybersecurity.

Smart Grid Interoperability Panel (SGIP)



INTEROPERABILITY AND THE SMART GRID

Under the Energy Independence and Security Act (EISA) of 2007, the National Institute of Standards and Technology (NIST) has "primary responsibility to coordinate development of a framework that includes protocols and model standards for information management to achieve interoperability of smart grid devices and systems." The Smart Grid Interoperability Panel (SGIP) was launched in November 2009 to support NIST in fulfilling these responsibilities.

WHAT IS INTEROPERABILITY?

Interoperability refers to the capability of different systems and devices to communicate and operate effectively with one another. Devices that are fully interoperable are often described as having "plug and play" characteristics (i.e., connect them and they work together).

As an example, consider how interoperability relates to electric vehicles (EVs). One of the barriers to widespread adoption of EVs is the interoperability of charging interfaces. Just imagine the frustration of driving around town looking for the right outlet to match your car's plug. The benefit of interoperability, in this case, is that all car and charger manufacturers would conform to a selected standard (or set of standards). Interoperability compliance would ensure that any car can be charged from any corresponding charger.

Two of the first interoperability standards adopted by the SGIP relate to the charging of electric vehicles, and more EV-charging standards are expected to be considered by the SGIP in coming months.

The concept of interoperability applies not only to hardware, such as an EV-charging plug, but it also applies to software. For example, the Smart Grid will use information technology to enable two-way communication and the sharing of large amounts of data and information between Smart Grid devices, services, and systems. To ensure that this information is shared effectively, the Smart Grid needs a standardized format for this data—just like people need a common vocabulary, grammar, and language structure to communicate with each other. The SGIP has adopted a standard that provides the foundation for an "energy usage data model," which spells out the rules and structure necessary for the exchange of customer energy usage information. This interoperable standard deals with the means of exchange used by devices and services, and it will help consumers take control of their energy usage by providing real-time communication between utilities and consumers about power availability and cost.

WHY IS INTEROPERABILITY IMPORTANT?

Interoperability impacts customer satisfaction, system reliability, life cycle cost, and regulatory compliance. Interoperable devices provide customer choice and ease-of-use, leading to customer satisfaction. Devices that meet interoperability criteria have a clear path for testing and product certification, thereby improving the reliability of a system. Interoperability facilitates open system design, which allows for easier integration, expansion, and replacement, which lead, ultimately, to savings in system life cycle cost. And interoperability makes regulatory requirements easier to verify by providing uniform, standardized, and transparent information sharing. The market has seen how interoperability has enhanced industries such as telecommunications.

WHAT IS MEANT BY "A FRAMEWORK... TO ACHIEVE INTEROPERABILITY?"

In this case, the framework consists of standards; a conceptual architectural framework; a cybersecurity strategy; and a regimen for testing and certifying that standards are implemented correctly in Smart Grid devices and systems. Two related concepts must be differentiated in discussions of the framework:

Standards Conformance: This concept assumes that a solution can be tested to verify whether it conforms to a given standard or set of standards. In this sense, the verification of conformance ensures a necessary, but not sufficient, condition for a solution to be interoperable.

Interoperability Compliance: Because many standards have features or options that may be interpreted differently by different vendors, it is not uncommon that a solution deemed conformant to a standard is not interoperable. Hence, interoperability compliance verification is also necessary. Only then will the solution be sufficient to ensure the solutions to be "plug-and-play" ready.

HOW THE GRIDWISE® ARCHITECTURE COUNCIL VIEWS INTEROPERABILITY

The work of the SGIP builds upon the foundational work of the GridWise Architecture Council (GWAC). The GWAC is an independent group of volunteer domain experts established in 2004 and supported administratively by the U.S. Department of Energy.

Organizational	•8: Economic/Regulatory Policy •7: Business Objectives •6: Business Procedures
Informational	•5: Business Context •4: Semantic Understanding
Technical	•3: Syntactic Interoperability •2: Network Interoperability •1: Basic Connectivity

The GWAC has developed several different documents on the topic of interoperability for Smart Grid implementation, the best known of which is "The Interoperability Context-Setting Framework." This document defines eight interoperability "layers" that have come to be known as the "GWAC Stack." Each layer typically depends upon, and is enabled by, the layers below it. This layered format was modeled after the Open Systems Interconnection model (OSI model) for network architecture which was developed by the International Organization for Standardization (ISO).

In addition to these eight layers, the GWAC document identifies ten cross-cutting topics that impact interoperability, shown here.

Cross-Cutting Issues

- ↑ Shared meaning of content ↓
- ↑ Resource Identification ↓
- ↑ Time Synch & Sequencing ↓
- ↑ Security & Privacy ↓
- ↑ Logging & Auditing ↓
- ↑ Transaction & State Mgmt. ↓
- ↑ System Preservation ↓
- ↑ Performance/Reliability/Scalability ↓
- ↑ Discovery & Configuration ↓
- ↑ System Evolution ↓

WHAT DOES IT TAKE TO PRACTICE INTEROPERABILITY?

Any business that wants to practice interoperability needs to first understand the impacts to the entire organization. Following an architecture like the GWAC Stack as a roadmap, the purchase of equipment and design solutions need to meet the criteria for syntactic, semantic, and pragmatic interoperability as presented in the GWAC paper. Last but not least, test practices need to be adopted to verify standards conformance and interoperability compliance throughout the life cycle of a solution.

SGiP

SMART GRID INTEROPERABILITY PANEL

HOW THE SGIP ENSURES INTEROPERABILITY IN THE SMART GRID

The SGIP has established a consensus-based process to support the interoperability framework. The SGIP standards coordination process, shown below, was constructed solely for the purpose of ensuring interoperability.

SGIP KEY TEAMS

Domain Expert Working Groups (DEWGs)

Through the analysis of use cases, DEWGs can support the fulfillment of Smart Grid applications.

Priority Action Plans (PAPs)

Based on the DEWGs' analyses, PAPs may be launched to address either a gap where a standard is needed or an overlap among two or more related standards that needs to be resolved.

Smart Grid Architecture Committee (SGAC)

The efforts of the DEWGs and PAPs are used to inform the development of a Smart Grid conceptual reference model. The SGAC is responsible for creating and refining this conceptual reference model.

CyberSecurity Working Group (CSWG)

Each SGIP activity is coordinated closely with the CSWG to ensure that cybersecurity and privacy are built into the Smart Grid from the ground up.

Smart Grid Testing and Certification Committee (SGTCC)

The SGTCC creates and maintains the necessary documentation and organizational framework for conformance, interoperability compliance, and cybersecurity testing and certification for SGIP-recommended Smart Grid standards.